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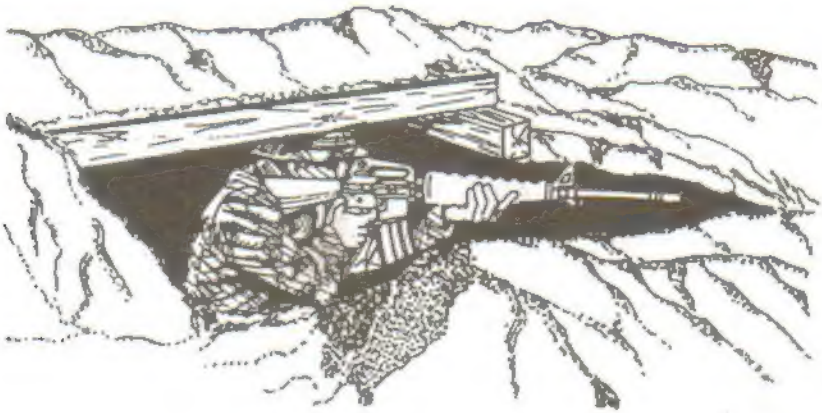
GTA 05-08-001

SURVIVABILITY POSITIONS



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HEADQUARTERS, DEPARTMENT OF THE ARMY

AUGUST 1993

COMMANDER'S RESPONSIBILITIES

esponsibilities of the commanders are to –

- Protect troops.
- Plan and select location of survivability positions (fighting positions and protective positions or bunkers).
- Improve and maintain unit survivability.
- Provide materials
- Supervise construction
- Inspect survivability position.
- Obtain technical advice from engineers, as required

eferences: FM 5-103, Chapter 4, and FM 5-34, Chapter 4.

DO--	DON'T--
Ensure adequate material is available.	• Fail to supervise.
Dig down as much as possible.	• Use sand for structural support.
Maintain, repair, and improve positions continuously.	• Use sandbags for structural support.
Inspect and test position safety daily, after heavy rain, and after receiving direct and indirect fires.	• Forget to camouflage.
Revet excavations in sandy soil (see 7, step 2).	• Drive vehicles within 6 feet of a position.
Interlock sandbags for double wall construction and corners.	• Overfill sandbags.
Check stabilization of wall bases.	• Put soldiers in marginally safe survivability positions.
Fill sandbags approximately 75 percent.	• Take shortcuts.
Construct to standard.	• Build above ground unless absolutely necessary.
Use common sense.	• Forget lateral bracing on stringers.

SUMMARY OF MATERIALS

In a combat situation, it may be necessary to improvise construction of a survivability position by using materials normally associated with the construction. Examples of field expedient materials are—

WALL REVETMENT

Sheet metal
Corrugated sheet metal
Plastic sheeting
Plywood
Air mat panels
Air Force air load pallets

OVERHEAD COVER STRINGERS

Single pickets
Double pickets
Railroad rails
I beams
Pipe, 2 inches in diameter and larger
Timbers, 2"x4", 4"x4", and larger
Reinforced concrete beams
55-gallon drums, cut longitudinally in half
Large diameter pipe/culverts, cut in half
Precast concrete panels, 6-8 inches thick
Airfield panels
Air Force air load pallets
Shipping pallets

STAND-ALONE POSITIONS

Concrete catch basins, valve pits, and utility boxes.
Military vans
Consolidated express (CONEX) containers.
Large diameter pipe/culvert
Steel water tanks
Other storage tanks (cleaned and ventilated)
Vehicle hulks

WALL CONSTRUCTION (BUILDING UP)

Sand grid material
55 gallon drums, filled with sand
Expended artillery shells, filled with sand
Shipping boxes/packing material
Prefabricated concrete panels
Prefabricated concrete traffic barriers

NOTE: All positions require a minimum of 18 inches of dry sand for overhead cover (double thickness for wet sand.)

PRECONSTRUCTION PHASE

Determine the level of protection required through intelligence preparation of the battlefield (IPB); observation and fire, concealment and cover, obstacles, key terrain, and avenues of approach (OCOKA); and mission, enemy, terrain, troops, and time available (METT-T). See page 4, Table 1, for a summary of protection levels of common threat weapons systems for direct and indirect fire.

PROTECTION FOR FIGHTING POSITIONS

Position may be hasty or deliberate, depending on availability of time ar material. Positions may be dug manually or mechanically. Table 1 shov required thickness for protection against direct and indirect fire.

Table 1. Material thickness (cm/in) for protection against direct and indirect fire.

Material	Direct Fire			Indirect Fire		
		HE-Shaped Charge		Mortar	Mortar/Rocket/HE Shel	
	Small Caliber (7 62)	85mm (RPG7)	107mm and 120mm (RCLR) (SAGGER)	82MM	120mm and 122 mm	152mm
Concrete	30 (12)	76 (30)	91 (36)	10 (4)	13 (5)	15 (6)
Gravel, small rocks, bricks, rubble	51 (20)	61 (24)	91 (36)	25 (10)	46 (18)	51 (20)
Soil, sand	107 (42)	198 (78)	244 (96)	30 (12)	51 (20)	76 (30)
Timber	91 (36)	229 (90)	274 (108)	20 (8)	30 (12)	36 (14)
Snow (tamped)	183 (72)	396 (156)	None	152 (60)	152 (60)	152 (60)

NOTE. HE = high explosive

TYPES OF FIGHTING POSITIONS

Figures 1 through 3 show types of fighting positions. Fighting positions are for protection of personnel and equipment directly involved in combat.

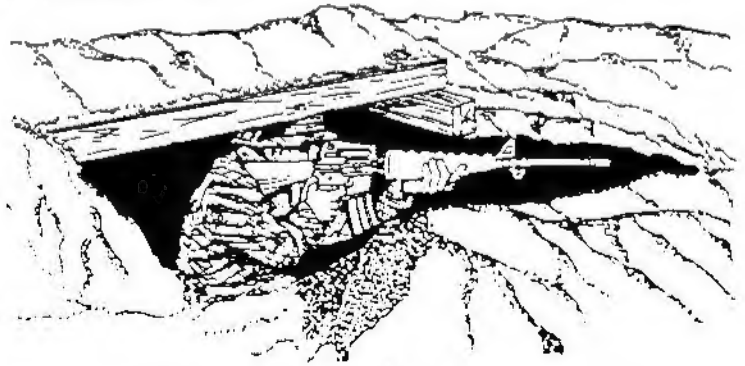


Figure 1. One-soldier fighting position

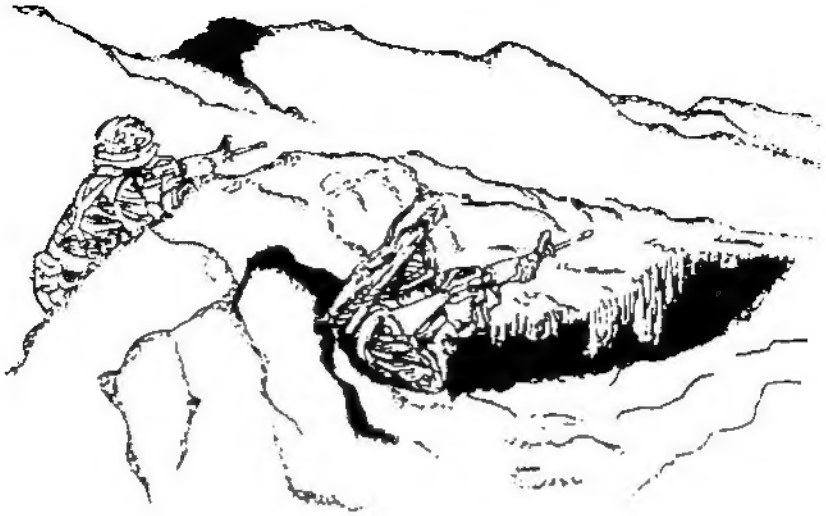


Figure 2. Two-soldier fighting position.

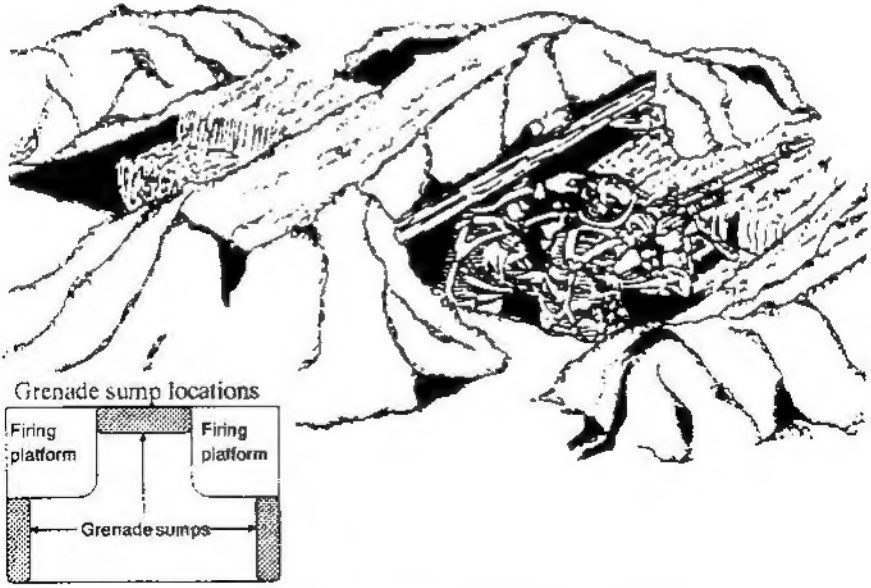


Figure 3. Crew-served fighting position.

POSITION PLANNING

Table 2 contains the estimated construction time for individual fighting positions and the protection they provide.

Table 2. Characteristics of individual fighting positions.

Type of Position	Estimated Construction Time w/hand – tools (man-hours)	Nuclear Weapons
Hasty		
Crater	0.2	Fair
Skirmisher's trench	0.5	Fair
Prone position	1.0	Fair
Deliberate		
One-soldier position	3.0	Fair
One-soldier position with 1½-ft overhead cover	8.0	Good
Two-Soldier position	6.0	Fair
Two-Soldier position with 1½-ft overhead cover	11.0	Good
Light antitank weapon (LAW) position	3.0	Fair

NOTE: Deliberate positions do not provide protection from medium artillery (fire) closer than 30 feet.

CONSTRUCTING A FIGHTING POSITION

Figures 4 through 9 outline the steps for construction of a fighting position.

STEP 1: Excavate earth.

Slope walls 1:4 (for every 4 feet in depth, slope back 1 foot).
Pile dirt a minimum (min) of 1 foot from the edge of excavation or ¼ C, whichever is greater.

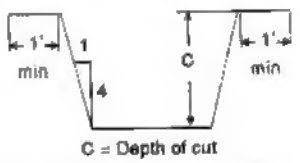


Figure 4. Earth excavation.

STEP 2: Install revetment.

Use sheeting material and pickets to revet walls in sandy soil to prevent cave-in.
Tie back pickets and posts.
Drive pickets at least 1/3 C into the ground.

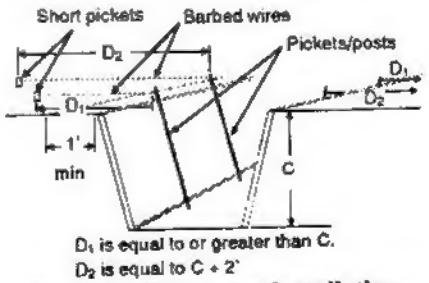


Figure 5. Revetment installation.

STEP 3: Install floor drain and hand-grenade sumps (seasonal, optional).

- Slope the floor from rear to front.
- Use pallets for floor cover, if necessary.
- Install a 1' x 1' rock sump the length of the position.
- Install a hand-grenade sump on the front wall (a minimum of 5 inches wide at a 45-degree angle.)

STEP 4: Install supports for overhead stringers (bearing plates)

- Set supports back from the edge of the excavation at least 1 foot or ¼ C, whichever is greater.
- Use timbers, pipes, or concrete beams for supports
- Dig in supports approximately ½ their height.

STEP 5: Install stringers.

- Use stringers that are 2"x4", 2"x6", or 4"x4" timbers; pipes; or pickets.(Use best/largest available.)
- Use tables on pages 13 and 14 for stringer spacing.
- Use lateral bracing (sandbags, ammo cans) to prevent rolling.
- L = Span of stringer.
- PL = Position length.
- h = Stringer spacing.
- C = Depth of cut.
- SL = Support length (SL = PL + C).

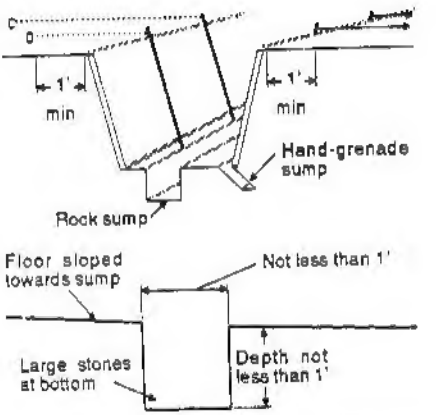


Figure 6. Floor drain and hand-grenade sump installation.

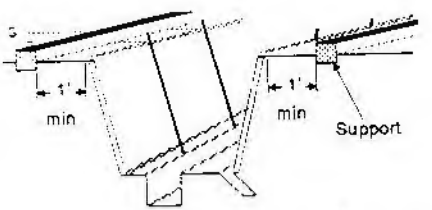


Figure 7. Overhead stringer support installation.

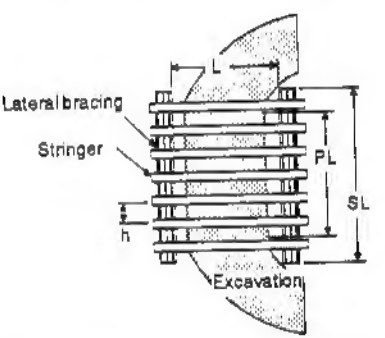
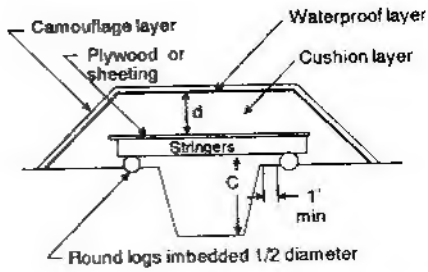


Figure 8. Stringer installation.

STEP 6: Install overhead cover (OHC) and camouflage.

- Use sheeting or 1-inch plywood for dustproof layer (could be boxes or plastic panel).
- Use sandbags with sand for cushion layer.
- d = depth of cushion layer (1½ feet minimum).
- Use plastic or a poncho for waterproof layer.
- Camouflage with surrounding topsoil and lightweight camouflage screen system (LCSS).



Add rock layers above waterproof layer to stop delayed bursts of mortars up to 82mm.

Figure 9. Overhead cover and camouflage installation.

CONSTRUCTION PROTECTIVE POSITIONS

Protective positions are for protection of personnel and equipment which are not normally directly involved with fighting the enemy. However, during defensive situations, they can be used as fighting positions as shown in Figures 10 and 11. Basic criteria to consider when designing a protective position or bunker are the purpose (command post or fighting position) and the degree of protection desired (small arms, mortars, or bombs) (see page 4, Table 1). The bunker can be constructed completely or partially underground. Prefabrication of bunker assembly (wall and roof) allows rapid construction and placement flexibility. When using construction timber, avoid notching. Add a waterproof layer before camouflaging. A variety of positions can be made with locally procured materials. Common field bunkers are shown in FM 5-103, Chapter 4. For additional bunker designs, see FM 5-103, Appendix B.

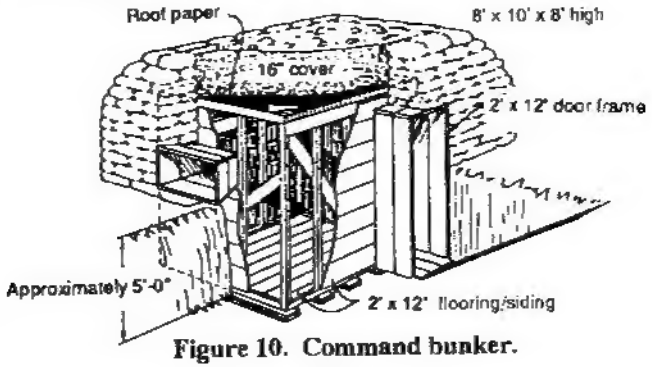


Figure 10. Command bunker.

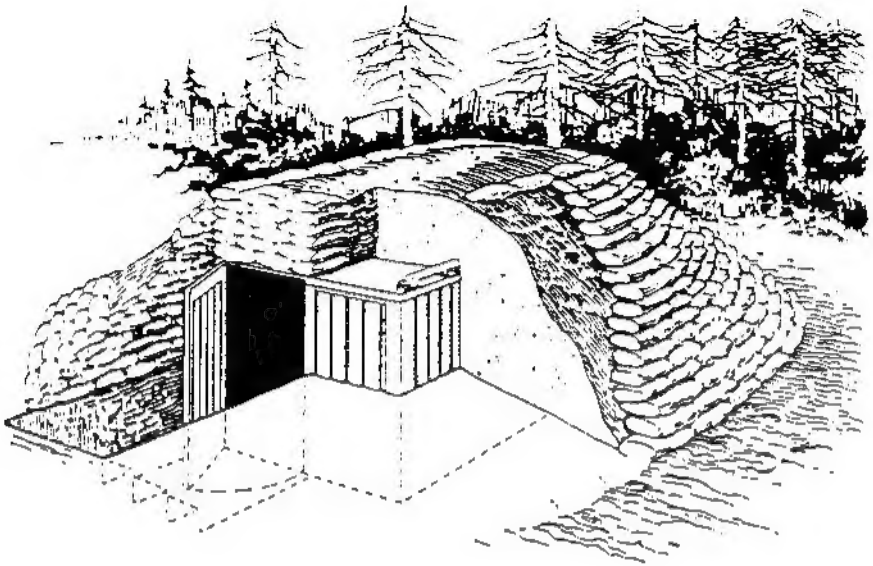


Figure 11. Metal shipping container shelter.

CONSTRUCTING BUILT - UP POSITIONS

In situations where survivability positions must be constructed above ground (for example, where bedrock prevents excavation), general considerations are --

- Use only when absolutely necessary.
- Use camouflage with surrounding top soil. Slope to blend in with the terrain.
- Do not use sandbags as structural support (for example, a sandbag wall supporting OHC).
- See page 2 for appropriate construction and structural material.
- Consult FM 5-103 for above ground bunkers and shelters.
- When using metal shipping container upside down. The original bottom is designed to support more load.

CONSTRUCTING WITH SANDBAGS

The stretchers and headers technique serves to tie together double walls as illustrated in Figure 12. Figure 13 shows staggering of sandbags. Figures 14 and 15 show anchoring methods.

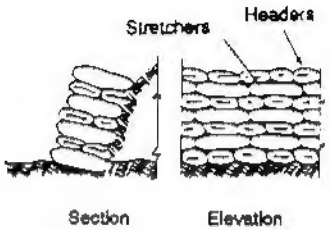


Figure 12. Stretchers and headers.

Figure 13. Staggering of sandbags.

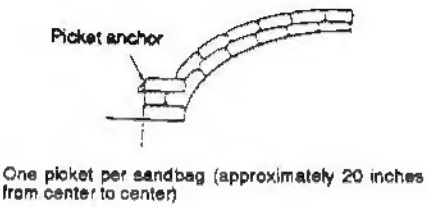


Figure 14. Picket anchor.

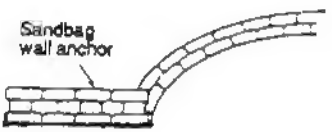


Figure 15. Sandbag achor.

FIGHTING POSITION DESIGN

Table 3, page 13, and Table 4, page 14, provide information for designing fighting positions using 8-foot picket stringers and 4"x4" wood stringers. Following is an example of each:

8-FOOT STEEL PICKET

L = 6'
d = 2'
c = 5'
PL = 6'
SL = 11'
h = 5 inch center-to-center spacing (from Table 3, page 10.
8-foot pickets (open side down).
16 pickets required.

4"x4" WOOD STRINGER

L = 6'
d = 2'
c = 5'
PL = 6'
SL = 11'
h = 10 inch center-to-center spacing (from Table 4, page 11).
4"x4" stringers.
9 stringers required.

CENTER-TO-CENTER SPACING FOR STEEL PICKETS

Use the following procedure to determine center-to center stringer spacing

1 Determine L ,span length n feet For L ≤ 3 use column a L≤ = equal to or ,ess than) for L≤ 6' use column b for L≤ 9 use column c (see Table 3)

2 Determine the number of ,ayers of sandbags required One sandbag ,ayer s equal to approximately 5 inches The ,ayers of sandbags equa the cushion layer of your OHC des gn

3 Use the smallest number that s greater than the number of ,ayers in your design

4 Intersect row and column to determine the maximum span between steel picket stringers

5 Add four sandbag layers f using a burst ,ayer

Table 3. Center-to-center spacing for steel picket stringer

Number of Sandbag layers	a	b	c
	Span Length Feet		
	3	6	9
Single Picket*	Center-to-Center Spacing inches		
2 10 inches		7	6
5 ,25 inches,	6	5	4
10 (50 inches)	4	4	3
15 (75 nches)	4	3	2
20 (100 Inches)	3	3	2
Double Picket**			
2 ,10 inches)	7	7	7
5 ,25 nches)	7	7	7
10 ,50 nches,	7	6	5
15 ,75 nches	4	3	2
20 ,100 nches	6	5	4

* Used with open s de down

** Two pickets are we ded together every 6 inches along the span to form box beams

CENTER-TO-CENTER SPACING FOR WOOD STRINGERS

Use the following procedure to determine center-to-center stringer spacing:

Table 4. Center-to-center spacing for wood stringers.

NORMAL STRINGER SIZE(inches)	DEPTH OF SOIL (c) M (Feet)	SPAN LENGTH (L) M (Feet) 0.6 (2)	1.2 (4)	1.8 (6)	2.4 (8)	3 (10)
		CENTER-TO-CENTER STRINGER SPACING (h) CM (Inches)				
		82-mm Contact Burst				
2" x 4"	0.6 (2)	7.6 (3)	10 (4)	10 (4)	10 (4)	8 (3)
	0.9 (3)	46 (18)	30 (12)	20 (8)	13 (5)	8 (3)
	1.2 (4)	46 (18)	36 (14)	18 (7)	10 (4)	8 (3)
2" x 6"	0.6 (2)	10 (4)	18 (7)	20 (8)	20 (8)	15 (6)
	0.9 (3)	46 (18)	46 (18)	41 (16)	30 (12)	20 (8)
	1.2(4)	46 (18)	46 (18)	46 (18)	28 (11)	18 (7)
4" x 4"	0.6 (2)	18 (7)	25 (10)	25 (10)	22 (9)	18 (7)
	0.9 (3)	46 (18)	46 (18)	46 (18)	30 (12)	20 (8)
	1.2(4)	46 (18)	46 (18)	46 (18)	25 (10)	18 (7)
		120-mm and 122-mm Contact Bursts				
4" x 8"	1.2 (4)	9 (3.5)	10 (4)	13 (5)	13 (5)	15 (6)
	1.5 (5)	30 (12)	30 (12)	30 (12)	28 (11)	25 (10)
	1.8 (6)	46 (18)	46 (18)	46 (18)	41 (16)	30 (12)
6" x 6"	1.2 (4)	-	-	14 (5.5)	15 (6)	15 (6)
	1.5 (5)	36 (14)	36 (14)	33 (13)	30(12)	25(10)
	1.8 (6)	46 (18)	46 (18)	46 (18)	41 (16)	30 (12)
6" x 8"	1.2 (4)	14 (5.5)	15 (6)	20 (8)	23 (9)	25 (10)
	1.5 (5)	46 (18)	46 (18)	46 (18)	46 (18)	43 (17)
8" x 8"	1.2 (4)	19 (7.5)	23 (9)	28 (11)	30 (12)	33 (13)
	1.5 (5)	46 (18)	46 (18)	46 (18)	46 (18)	46 (18)

Table 4. Center-to-center spacing for wood stringers.

NORMAL STRINGER SIZE(inches)	DEPTH OF SOIL (d) M (Feet)	SPAN LENGTH (L) M (Feet)				
		0.6 (2)	1.2 (4)	1.8 (6)	2.4 (8)	3 (10)
		CENTER-TO-CENTER STRINGER SPACING (h) CM (Inches)				
		152-mm Contact Burst				
4" x 8"	1.2 (4)	-	-	-	-	9 (3.5)
	1.5 (5)	15 (6)	15 (6)	15 (6)	18 (7)	18 (7)
	1.8 (6)	43 (17)	41 (16)	41 (16)	30 (12)	25 (10)
	2.1 (7)	46 (18)	46 (18)	46 (18)	38 (15	28 (11)
6" x 6"	1.5 (5)	18 (7)	20 (8)	20 (8)	20 (8)	18 (7)
	1.8 (6)	46 (18)	46 (18)	38 (15)	30 (12)	25 (10)
	2.1 (7)	46 (18)	46 (18)	46 (18)	38 (15)	28 (11)
6" x 8"	1.2 (4)	-	-	-	-	15 (6)
	1.5 (5)	25 (10)	28 (11)	30 (12)	30 (12)	30 (12)
	1.8 (6)	46 (18)	46 (18)	46 (18)	46 (18)	43 (17)
8" x 8"	1.2 (4)	-	-	-	-	20 (8)
	1.5 (5)	36 (14)	38 (15)	41 (16)	43 (17)	41 (16)
	1.8 (6)	46 (18)	46(18)	46 (18)	46 (18)	46(18)

NOTES.

1. The maximum beam spacing listed is 46cm (18 in.). A minimum of 1-inch wood or plywood should be used over stringers to support the earth cover for 82-mm bursts; 2-inch wood or plywood should be used for 120-mm or 152-mm bursts.

2. Lumber used in these spacing calculations is high quality and knot free. For lower grade lumber, spacing should be reduced.

3. When only 2"x4" lower grade is available, consider nailing two 2"x4" together to produce 4"x4" stringers.

4. As soil depth increases, contact burst live load decreases. Therefore, in many cases stringer spacing may increase even though dead load has increased

INSPECTION CHECKLIST

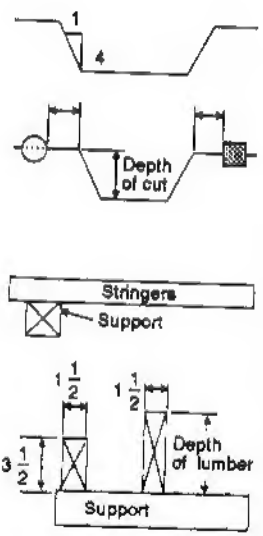
The following checklist is provided to help supervisors ensure the safety of soldiers' fighting positions:

- Site location tactically sound
- Low profile maintained
- Materials of structural quality (standard construction material)
- Excavation walls sloped
- Setback for overhead is a minimum of 1 foot or ¼ C
- Stringers--
  - Firmly on a structural support
  - Spacing calculated using tables on pages 13 and 14
  - 2"x4" or 2"x6" stringers used on edge (the strength is in the depth of the lumber)

Revetment construction--

- Sheeting supported by pickets
- Pickets tied back

GO NO GO



- Overhead covers--

  - Structural layer

  - Dustproof layer (plywood or panels)

  - Cushion layer at least 18 inches deep

  - Waterproof layer in place (also repels liquid chemicals)

  - Burst layer at least 18 inches deep (if used)

  - Camouflage in place

- Sandbags--

  - Sandbags filled approximately 75 percent

  - Bags lapped if single walls

  - Double walls tied together

  - Base height supported or walls curved

GO	NO GO

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